MEMOIRS

became

BROCHURES.

Victoria Museum, Launceston, Tasmania.

MEMOIR

ON

"Macropus Anak,"

From King Island.

With the Compliments of the
Museum Committee.

Photographs by F. E. Burbury, Esq.

EXAMINER PRINT.

MEMOIR

ON

"Macropus Anak,"

A FOSSIL KANGAROO FROM KING ISLAND.

The Specimen which served as the subject of this Memoir is exhibited in Case 43, in the Victoria Museum, Launceston, together with other fossil remains from the same Island.

HISTORY.

The bones were discovered by Mr. James McKie Bowling, of Surprise Bay, King Island, embedded in a soft friable (shell) limestone rock, of marine origin, and after extraction, were generously donated by him to our Museum. As far as is known to me this is the first time "Macropus Anak," or any of the larger pleistocene Mammals of Australia have been found upon the Islands of Bass Straits, hence the fact seemed to be worth recording.

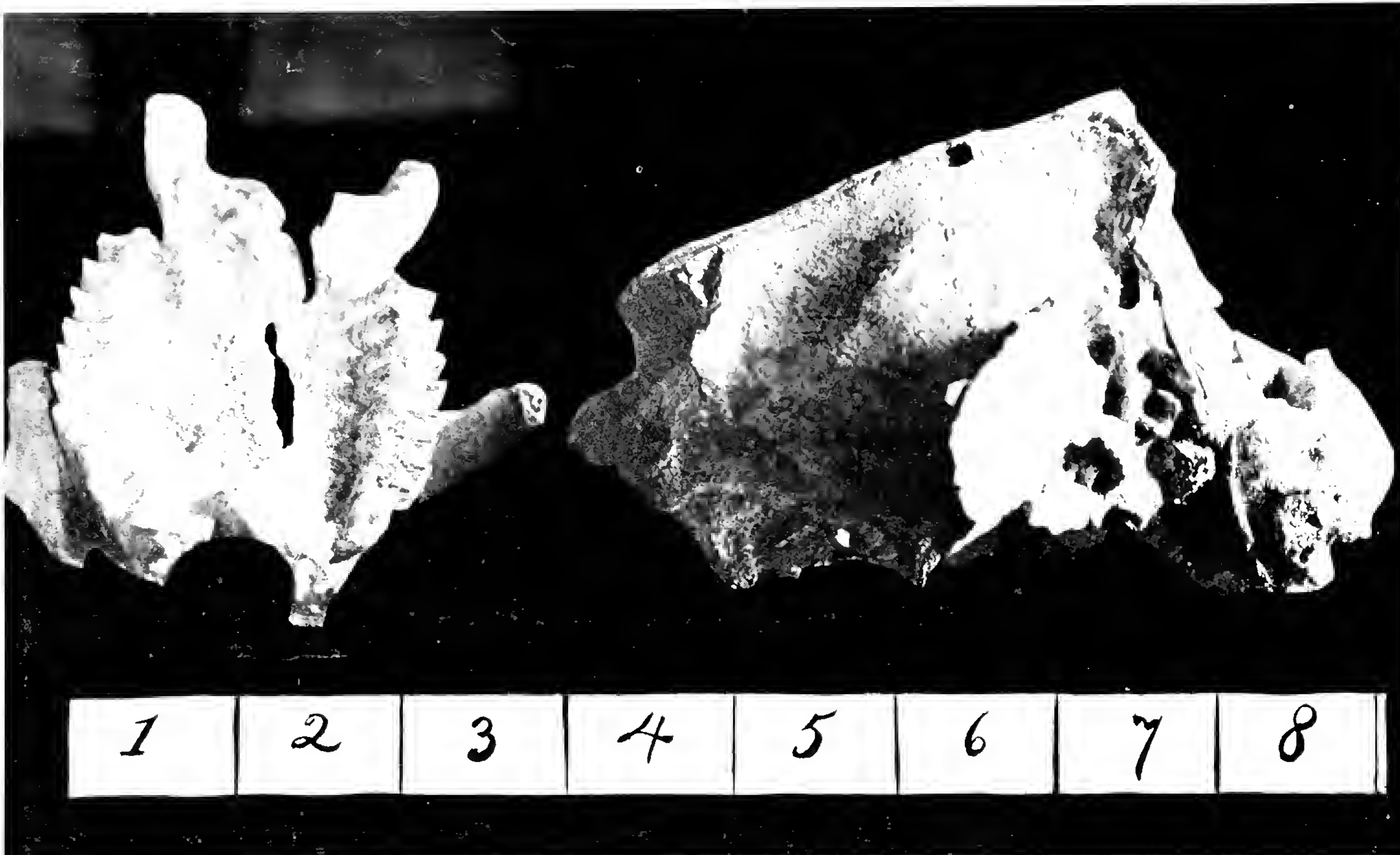
SKULL.

As will be seen by an examination of Photograph No. 1, the whole of the facial portions of the skull are broken away, but the maxillary bones, together with the cheek dentition, are available for study - and in the picture are arranged to show the palate and

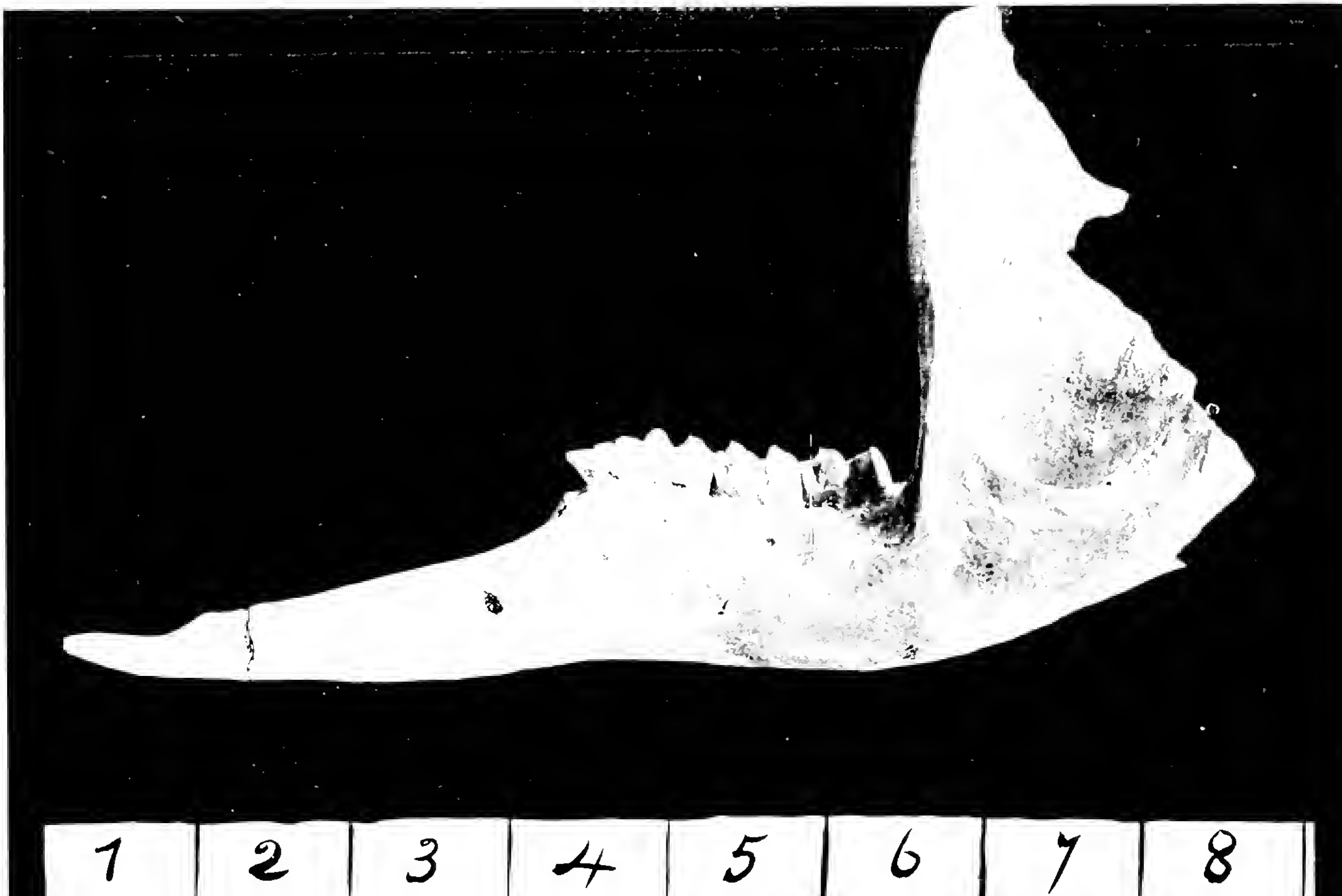
teeth. Posteriorly, the atlas vertebra will be found adhering to the occipital condyles. With a little patching the lower jaws were restored to a sufficient degree of perfection to enable me to make a basal measurement of the skull as a whole, and when the condyle of the jaw was placed in the glenoid cavity of the skull, the total length was found to be $9\frac{3}{4}$ inches, or nearly $2\frac{1}{4}$ inches larger than the skull of the Tasmanian forester kangaroo ("MACROPUS GIGANTEUS"). In considering the measurements given throughout the present Memoir it should be noted that the animal was immature at the time of its death, as is evidenced by the unankylosed condition of all the epiphyses, and the measurements of the teeth. In the lower jaws the teeth can all be examined by an appeal to both specimens, but from the more perfect (left), which was used for Illustration No. 2, pre-molar No. 4 is missing. Lower molar No. 4, in either jaw, shows a small but distinct hind talon, which is unfortunately not caught by the photograph.

In this connection it is of interest to note that although this character was not originally included in the specific distinctions of "MACROPUS ANAK," it is now so included by Lydekker in his Catalogue of Fossil Mammals (part 5, page 214), in order to extend the species to include various synonyms. The cheek line of "MACROPUS ANAK" is given by Lydekker as 70 to 72 M.M. in length; the present specimen is, however, only 68 M.M., but the immaturity of the animal must be recalled also the fact that Lydekker states that if more specimens were available for study, a greater variation might be deduced in the respective dentitional lines of individual specimens. Fortunately for us, a second detached and unassociated right jaw of a mature animal was found in quite another matrix by Mr. Bowling, and, although much broken, it would seem to have had a tooth line of about 75 M.M. This, although large for "MACROPUS ANAK," is still too short for "MACROPUS BREHUS."

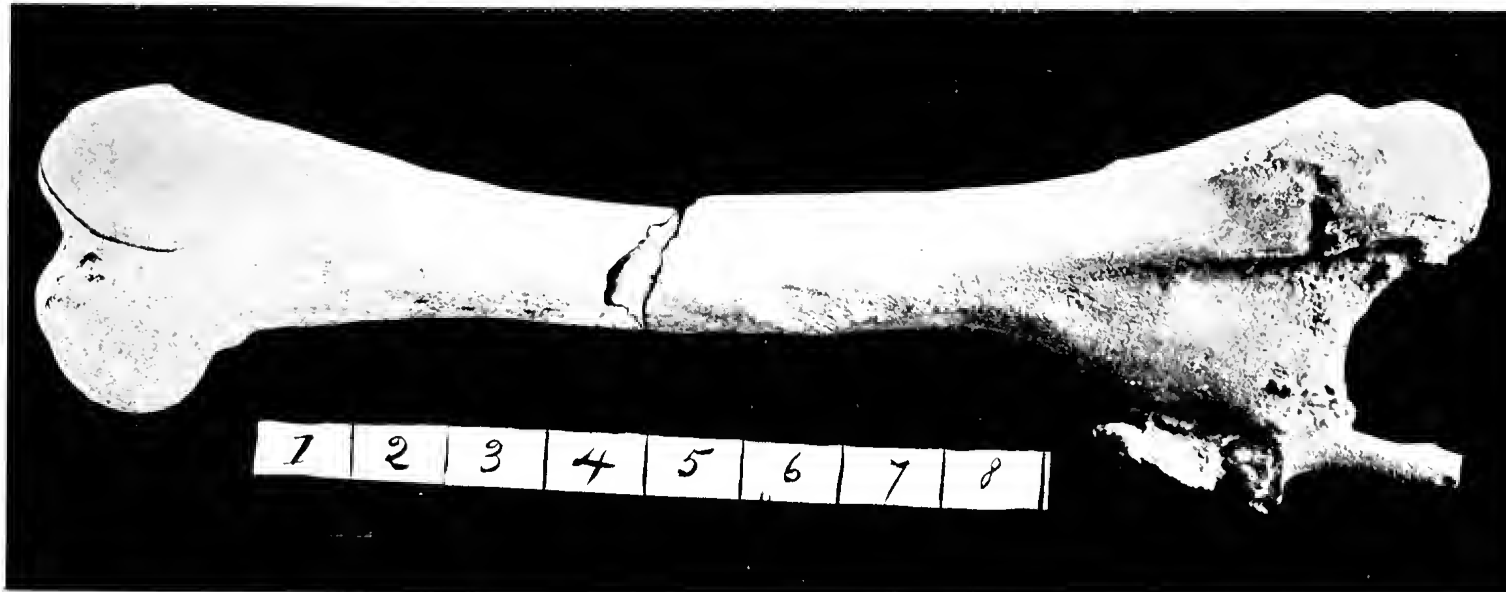
Photograph No. 3 shows the femur, which is snapped into two pieces in the centre of the shaft. This bone has a total length of $14\frac{5}{8}$ inches, a proximal width of 4 inches, a distal width of $3\frac{1}{2}$ inches, while the least girth of shaft is equal to $4\frac{1}{2}$ inches. Part of the pelvis, including about half of the acetabulum, still adheres to the head of the femur, cemented thereto by the matrix. The broken shaft of this bone enables a measurement of thickness to be recorded, which, when taken from the outer table to the medullary cavity amounts, in its thickest part, to over $\frac{3}{8}$ of an inch.



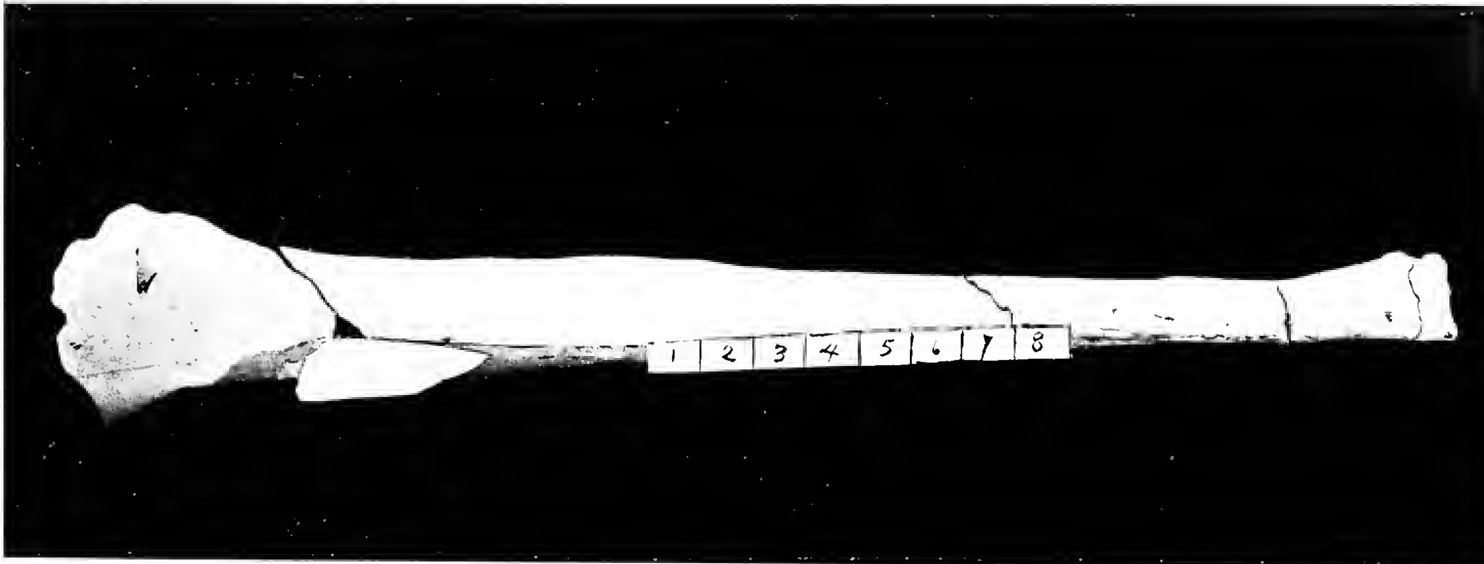
Photograph No. 1.



Photograph No. 2.



Photograph No 3.



PHOTOGRAPH No. 4.

Photograph No. 4 is the tibia, broken into no less than four pieces, and not quite perfect as regards length, but still very nearly so. The proximal and distal ends are preserved, and, together with the shaft, as at present constituted, measure over 26 inches in length.

One scapula, a humerus, radius, ulna, and part of the wrist, together with a few ribs and several vertebræ, are also sufficiently intact to yield comparative osteological data.

The importance of the specimen as an aid to the determination of the later geological history of the Island is obvious.

The scale in the photographs is English inches.

The following measurements are also of interest:

Humerus (distally imperfect in width)	$9\frac{1}{2}$	inches	long
Radio Ulnar length (imperfect) ...	$12\frac{1}{4}$	"	"
Calcaneum	$4\frac{1}{2}$	"	"
Metatarsal bone	$7\frac{3}{4}$	"	"

H. H. SCOTT,

Curator.

Launceston Museum.

November 3rd, 1905.

Victoria Museum, Launceston, Tasmania.

MEMOIR

ON

"Procoptodon Rapha"

(Owen)

From King Island.

With the Compliments of the Museum Committee.

Photographs by F. E. Burbury, Esq.

MEMOIR on the Discovery of a Fossil Kangaroo of the Genus "Procoptodon," in the Pleistocene Formations of King Island.

CONTINUING his researches among the pleistocene rocks at Surprise Bay, King Island, Mr. James McKie Bowling was fortunate enough to add another specimen to the interesting collection he has already donated to this Museum. The present accession to our knowledge comes in the shape of a fragmentary skull of a small species of the genus "PROCOPTODON," seemingly that of "P. RAPHA" (*Owen*), of which the following notes will be of interest.

The total length of the specimen is 100 M.M., and embraces the whole of the anterior part of the skull, and most, if not all, of the region surrounding the unossified palatal tract, together with part of the right ramus of the mandible.

The line of fracture through the specimen reveals an alveolus upon either side of the palate, from which it may be inferred that the dentition present in the skull was not that of maturity, moreover the teeth show an absence of wear, and the enamel ridges are extremely keen. The incisor teeth are perfect upon the left side, but minus the large hindermost tooth upon the right side. The anterio-posterior length of this incisor set, upon the side still intact, is 20 M.M. Upon the opposite side, however, the first incisor curves outwards 1 M.M. in advance of its fellow, but this is not included in the measurements. The diastema is 22 M.M. long, measured between the enamel surfaces of the teeth. The premolar *in situ* (presumably No. 3) is 9 M.M. long, the first molar in position being 10 M.M. long, the second 11 M.M., and the third and fourth 12 M.M. each—thus bringing up the total length of the cheek line to 54 M.M.

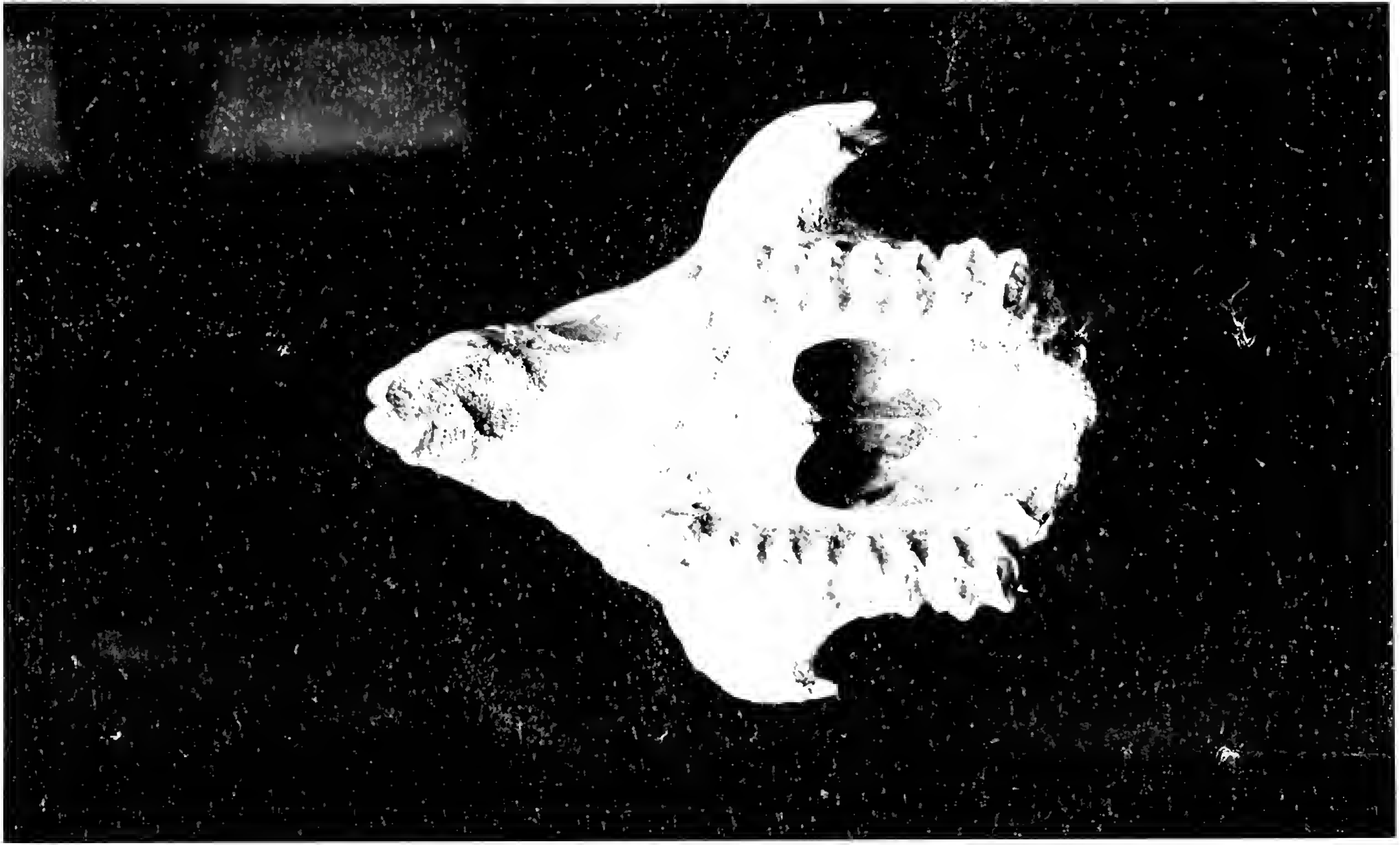
The premolar is wide, and shows the character of a pounding tooth, upon which the genus was founded by Prof. Owen. The true molars have their enamel plates raised into vertical folds. The greatest width across the palate is 30 M.M. or 51 M.M. if made to include the teeth themselves. Turned upside down, with a vertical rod against the incisor teeth, the distance to the palatal vacuities of the skull is 60 M.M., the measurement being carried 7 M.M. out of the central line so as to embrace the most anterior part of the curve in either maxillary. The nasals, which are slightly imperfect in length, are 47 M.M. long, and 37 M.M. wide. The frontals are centrally depressed, with a tendency to form a slight ridge over the orbit, their greatest width being 64 M.M. The jaw shows the crowns of three molar teeth, two of which are in advance of the coronoid process. At the foremost of these teeth the jaw is smashed into two pieces, and was thus broken prior to its inclusion into the stratum in which it was found. Owing to this, and other mutilations, an accurate measurement of the jaw is impossible, but it was certainly 150 M.M. long. Part of the left jaw is still ankylosed to its fellow at the symphysis, the fracture being in this case also, an old one. The smashing of the anterior portions of the jaws reveals sections of the right premolar, and the incisor tusk. The former has a sectional length of 16 M.M., which is 7 M.M. in excess of that in the superior maxillary, owing to which the diastema is reduced to 16 M.M. The exposed section of the tusk shows it to have been 12 M.M. by 9 M.M. in diameter.

CLASSIFICATION.

As reconstructed by Lydekker (Cat. Foss. Mamm., Brit. Mus., Vol. v., Page 233), the genus "Procoptodon" embraces three species and four synonyms. The three animals thus dealt with decreased progressively in size, the smallest being without enamel folds upon the teeth. Everything considered, the present specimen appears to agree best with the middle-sized animal, "Procoptodon Rapha," nothing that I can detect suggesting the need for a new species, particularly as it is admitted that great variation in size obtained among these ancient animals. Provisionally therefore, and without insisting too strongly upon the specific determination, I have listed the fossil as "Procoptodon Rapha" (*Owen*).

H. H. SCOTT,
Curator.

Launceston Museum,
November 6th, 1906.



SKULL, SHOWING CHEEK TEETH AND UNOSSIFIED PALATAL TRACT.

Victoria Museum, Launceston, Tasmania.

MEMOIR

ON

The Wedge-Tailed Eagle

"Uroætus Audax."

(Latham)

A Study in Avian Osteology

With the Compliments of
the Museum Committee

Photographs by F. E. Burbury, Esq.
and L. C. Pitfield. Esq.

EXAMINER PRINT.

F. L. Barbury, Photo.   WEDGE-TAILED EAGLE FROM WINKLEIGH. Beak to tip of tail, 3 feet 2½ inches. Spread of wing, 6 feet 9 inches.

NEST OF THE WEDGE-TAILED EAGLE,
Mount Direction, Southern Tasmania.

L. C. Pitfield, Photo.

Victoria Museum, Launceston, Tasmania.

Memoir

ON

The Wedge-Tailed Eagle

"Uroætus Audax."

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the Museum Committee.

Photographs by F. E. Burbury, Esq., and L. C. Pitfield, Esq.

PREFATORY NOTE.

This little study forms one of a series of practical dissections of animals and birds conducted from time to time to meet the necessities of Museum Work. All specimens so passed in review are kept in formaline, for future reference, and one-half of each specimen is left in the tissue. Specimens worked out in this way form the very best comparative collection a Museum can possess for osteological and palæontological purposes, the only objection to such being the amount of time involved in collecting the data. Against the objection, however, must be set the fact that the work can be conducted at odd moments, the fragments in use being quickly passed in and out of the preservative solution, and as one-half is always available in case of accident, the loss of a minute bone is of less moment.

Dissection out of formaline for osteological purposes is less clean than maceration, as far as the exposing of bony surfaces goes; but it is more certain, nothing being lost except by rank carelessness. Perhaps the ideal is to macerate one-half and retain the other half in formaline for dissection when needed.

Memoir on the Wedge-Tailed Eagle

"Uroætus Audax." (Latham)

NATURAL HISTORY.

The bold and predaceous nature of the wedge-tailed eagle early forced that bird into the notice of the settlers in Australia and Tasmania, and as quickly aroused the spirit of reprisal. Every man with a gun has been, and still is, the sworn enemy of the so-called "Eagle Hawk;" but if history is correctly recorded, the cunning of the eagle is equal to most occasions, and, truth to tell, our sympathy is largely with the bird.

The specimen chiefly referred to in the osteological text was a well-nourished male, clad in deep rolls of fat, that was shot upon the estate of the Hon. R. S. Scott, near St. Leonards, on August 25, 1926. The specimen used for the illustration was shot by Mr. J. C. Adams in June, 1928, and is said to have been killing lambs in the Winkleigh district for many years. Miss J. A. Fletcher, a keen observer of nature, recently sent me the following note: "I saw some very fine wedge-tailed eagles when climbing from Mangana to Ben Lomond last Easter. On the summit of the mountain some members of the party climbed a high pinnacle, and a dog which became separated from his master started to howl. Soon after an eagle came sailing up from the valleys below, and poised itself over the dog, evidently wondering what was the matter. He was joined by his mate, and then they both flew away, scared by the human climbers." None of the party had seen the eagles, and, indeed, it seemed as if the dog had located the proximity of the feathered foes by a sixth sense. A third bird of large dimensions, which reached us too late for stuffing purposes, was shot in 1929 by Mr. Malcolm Kirwan, of Poimena, North-Eastern Tasmania. This bird was killed after eating an enormous meal of mutton, supplied by a sheep that it had possibly hounded to death.

The slight expansion of the esophagus, which in these birds corresponds to the better defined "crop" of the fowl, is chiefly developed upon the right side, and in our specimen was found

to contain, in addition to a mass of fat and flesh, some of the wool of the defunct animal. The "proventriculus" was manifested chiefly by the presence of a circle of glands, and a slight thickening of the walls of the alimentary canal, rather than by actual expansion of it. This glandular area was about 10 mm. deep, and gave origin to thirty-five well-developed glands. The stomach, which was 150 mm. long, with a pyloric opening 7 mm. in diameter, was empty, as the bird had endured a long fast prior to the actual meal upon which it was engaged at the time of its death. The liver proved to have the right lobe larger than the left, in the following proportions:—

Right lobe—80 mm. long by 40 mm. wide.

Left lobe—60 mm. long by 35 mm. wide.

OSTEOLOGY.

SKULL.

The extreme length of the skull between verticals is 122 mm., or in "basal length" 112 mm. Its width across the fronto-zygomatic processes is 67 mm., and 50 mm. deep without the lower jaws. The palatines are 27 mm. in extreme width, and posteriorly meet the pterygoids upon a transverse suture, but do not overlap them. The inter-orbital fenestra is horizontally oval, 9 mm. long, and 5 mm. wide, and, as the skull has not been macerated, still exists as a fontanel. There is no supra-orbital fenestra. The optical foramen, which is vertically oval, is almost upon the same level as the inter-orbital, and in a macerated skull of similar size measured 6 mm. by 4 mm. In this latter skull the inter-orbital was an unusually large fenestra, namely, 13 mm. by 8 mm., this being an individual peculiarity. The depth of the beak in the maxillary regions is 26 mm., and its width at the maxillary processes 22 mm. The narial aperture is 16 mm. by 6 mm.

Upon the vertex of the skull there is a median depression similar to that found in the chestnut-faced owl, but less strongly marked. The quadrato-jugal styles measure 64 mm. in extreme length. The distance from the occipital condyle to the end of the sphenoidal rostrum is 55 mm. in the macerated skull.

The supra occipital bone is wider than deep, its extreme measurements being 50 mm. by 27 mm. From the lower edge of the supra occipital ridge to the upper rim of the foramen

magnum the distance is 13 mm., the foramen itself being slightly under 10 mm. in vertical diameter and rather over 10 mm. in transverse diameter. The occipital condyle is nearly round, is centrally impressed with a groove, and has a diameter of 4 mm. long in either direction. The foramen for the "vagus" and "glossopharyngeal nerves" is 9 mm. from the centre of the condyle, and that for the transmission of the "hypoglossal" 4 mm. from the centre of the condyle, while the "carotid" canal is 13 mm. from the same point.

SCLEROTIC RINGS.

The eyes of the specimen were but slightly dissected, and are still available for study. Apparently the sclerotic rings measure 38 mm. in diameter, with a rim depth of 16 mm.

JAWS.

The united rami of the mandible have a total length of 94 mm. and a depth in the coronoid regions of 13 mm., while the symphysis is 25 mm. long. The jaws are as a whole powerfully constructed, and their articular cavities are deeply impressed.

HYOIDS.

The thyro-hyals are compounded out of two pieces only, upon either side of the arch, instead of several, as in the case of the chestnut-faced owl. The chords of the arcs of these thyro-hyals measure 65 mm: the basi-hyal is 24 mm. long, and the uro-hyal 15 mm.

STERNUM.

The sternum has a total length of 125 mm., with a maximum anterior width of 60 mm., and a similar posterior width of 66 mm. If the keel is pressed against the measuring base board, and the costal border kept parallel with the base line, the depth of the entire sternum will be found to be exactly 57 mm. The length of the costal articular border is 60 mm. The internal depth of the sternum is 33 mm., measured between the fifth and sixth articular cavities. It should be particularly noted that the point just named is not situated between the fifth and sixth ribs, but midway between the fifth and sixth articular fossae of the costal series. The articular tracts of the coracoid bones are deeply marked, and meet with an angular overlap upon the central line of their lower concave portions, the left groove passing the centre, thus taking the left coracoid below the point of the right. This overlap cuts away a considerable part of the manubrium, and keeps it 8 mm. below the upper coracoidal border. The sternum of this eagle, unlike that of the Indian

vulture, has no posterior fontanelles, and the notching is also slight. A further comparison of the two sterna shows that the eagle is in every sense heavier and less gracefully built than the vulture, while the curve of the keel is flatter, and does not extend so far upwards in the direction of the manubrium. The actual measurements for the two sterna in question are as follow:—

Eagle—42 mm. from end of keel to the top of the coracoidal articular surface.

Vulture—36 mm. from end of keel to the top of the coracoidal articular surface.

Which amount of departure in the protraction of a curve makes a considerable difference to the general outline.

SCAPULAR ARCH.

Although in strictest truth it cannot be said that the scapula is ankylosed to the coracoid in this bird, yet the ligamentous union has so closely approached the ossific stage that to all practical purposes the union is complete—at least in the specimen here considered—doubtless due to age. The scapula contributes a moiety of exactly one-half to the glenoid cavity for the humerus, and when that cavity is seen with its articular cushions, synovial membrane, etc., the union between the two bones appears most complete.

The scapula itself has a total length of 100 mm., and is rather less riblike in shape than usual—markedly so when compared with that of the vulture. The outer border is convexo-concave, the concave portion being nearest the tip or distal end. The inner border is almost uniformly concave, the line breaking somewhat during the last quarter of its length. The greatest width of the bone is at its articular (or proximal) end, where it expands to 25 mm., after a previous contraction to 10 mm. At 20 mm. from the distal end it is 15 mm. in width.

CORACOID.

For the sake of convenience, a single coracoid is here selected for measurement and description, as in the case of the scapula just dealt with. The greatest length of the bone is 77 mm., its proximal width is 37 mm., and its distal width—taken from the articular cavity of the humerus to the subclavicular process—is 20 mm. Owing to the twisting of the bone, this latter measurement of width is practically at a right angle to the proximal width, the latter being taken from the inner articular point to the hyosternal process. A slit-like foramen, 3 mm. long, pierces the shaft 10 mm. below the "hyosternal

process." That portion of the humeral head which fails to find lodgment in the articular cavity of the coracoid rests against a wide band of ligament that is stretched between the coracoid and the scapula. In consequence of this arrangement there is no "os humero-scapulare" present.

OS FURCATORIUM.

The united clavicles form a powerfully constructed furculum, which is united ligamentously to the sternum, the ligament being attached to a process (interclavical) developed at the blending point of the original clavicular bones. The extreme length of the furculum is 62 mm., and its greatest width 75 mm. Neglecting the width of both bones, and measuring across the enclosed space, it will be found to vary from 48 mm. in the centre to 36 mm. across the upper processes. The greatest width of either moiety is at a point slightly lower than the coracoidal articular surfaces, where the bones expand to 20 mm. Near the articular surfaces there are large fossae, penetrated by pneumatic foramina. When placed upon the measuring base line (the outer surfaces and processes being downwards) the furculum rises 37 mm. vertically above the measuring board.

BONES OF THE SCAPULAR LIMB.

HUMERUS.

The humerus is 188 mm. long, with a proximal width of 47 mm., including the ulnar tuberosity and delto pectoral crest, while the distal width of the bone is 35 mm. There is a large sub-trochanterian fossa, whose walls extend downwards for 20 mm. before they subside upon the shaft; nowhere does its width exceed 12 mm. This fossa is extensively perforated by pneumatic foramina. Below the humeral head there is a well marked coraco-humeral groove, which, however, does not extend on to the palmar aspect of the bone. The nutrient foramina are situated as follows: Immediately below the sub trochanterian fossa there is one, whose position upon the shaft is best stated by a measurement taken from the head of the humerus, under which conditions the distance is 57 mm. The second is upon the palmar aspect of the shaft, 66 mm. lower than the first one, and 68 mm. from the distal end of the bone. The supra condylar fossa is large, but shallow, and the ectepicondylar process, although present, only rises to 4 mm. above the general line of the shaft. In its centre the shaft is nearly round, its diameter being 13 mm.

RADIUS AND ULNA.

The radius has a total length of 212 mm., with a proximal articular cup 11 mm. x 9 mm. in diameter, while the distal articular size of the bone is 16 mm. wide, forming a convex condyle that articulates with the radial carpal. The greatest diameter of the shaft of this bone is 7 mm.

The radial carpal, including its semi-ossified articular extensions, is 20 mm. x 15 mm., and 13 mm. in thickness. The first of the measurements, just cited, would be reduced to about 15 mm. in a macerated specimen, owing to the loss of half-ossified cartilage.

The ulna has a total length of 222 mm., a proximal width of 24 mm. x 17 mm., the distal end being 16 mm. x 16 mm. The diameter of the shaft at 50 mm. from the proximal end is 13 mm. x 11 mm., while in its centre the bone measures 11 mm. x 10 mm.

The ulnar carpal is a J-shaped bone, with articular diameters equal to 12 mm. and 7 mm.—a greatest width of 14 mm. and a total length of 18 mm.

Neither radius nor ulna is penetrated by pneumatic foramina. The nutrient foramen of the radius is situated 77 mm. from the proximal end of the bone; that of the ulna is 80 mm. from the same end.

CARPO-METACARPUS.

The carpo-metacarpus, which is very stoutly built, is 105 mm. long, with a proximal width of 25 mm. x 13 mm., and a distal width of 21 mm. x 12 mm. The pollex is 32 mm. long, with a proximal width of 12 mm. x 12 mm.

The greatest width of the two ankylosed shafts of the carpo-metacarpus is 17 mm.

The wide phalanx of the second digit is 39 mm. long and 17 mm. across its centre. The proximal articular width is 11 mm. x 11 mm., and the similar distal measurement 8 mm. x 6 mm.

The next phalanx of the second digit is 28 mm. long, with proximal articular measurements 9 mm. x 9 mm. The single phalanx of the third digit is 18 mm. long.

RIB SYSTEMS.

There are nine pairs of ribs, of which the two anterior pairs are freely suspended, and the remainder reach the sternum; the ossified sternals articulate directly with the costal border in

every instance in this bird, none being ligamentously attached to their fellows. The eighth and ninth pairs of ribs depend from the two anterior vertebræ of the synsacrum. As will be noted, this arrangement of the ribs differs materially from that found in the nocturnal birds of prey. In the owl, the seventh pair of ribs articulate with the anterior synsacral vertebra and their ossified costals are ligamentously joined to those of the preceding pair. In such a widely divergent bird as the crake ("Porzana") the costals of the eighth pair ligamentously join those of the seventh, while the ninth and tenth pairs of ribs are freely suspended from the two anterior vertebræ of the synsacrum.

This question of the articulation of the ribs is one of some importance to the working Osteologist, and it is not too much to say that even in first-class Museums errors of pleural articulation are to be found.

In the table of rib measurements hereunder given, it should be specially noted that the ribs have been removed from the vertebræ, and each placed upon the measuring block, between two vertical lines, and the result thus obtained duly listed—

First Pair of Ribs—26 mm. long, between vertical lines; distance between tubercula and capitula, 9 mm.

Second Pair of Ribs—53 mm. long, between vertical lines; distance between tubercula and capitula, 10 mm.

Third Pair of Ribs—64 mm. long, between vertical lines; distance between tubercula and capitula, 12 mm.

These are the first ribs to reach the sternum, and the first also to develop epi-pleural processes. The ossified sternals are 16 mm. long. The width across the ribs proper and the processes is 12 mm. in maximum measurement; the processes arise from the ribs at 14 mm. from their distal ends. As many as four pneumatic foramina penetrate the bone, while foramina of a similar kind pierce the sternal ribs at their distal ends. In some of the succeeding ribs the foramina become so numerous as to form a line of perforations down the rib surfaces upon the under side.

Fourth Pair—Although these ribs have a greater curve than the last pair, and are more powerfully constructed, yet their length is exactly the same, viz., 64 mm., between vertical lines. The distance between capitula and tubercula (hereafter called "proximal articular widths") is 15 mm.; the lower edges of the epi-pleural processes are also 15 mm. from the distal ends. The greatest expanse across the ribs and processes, taken at the apices of the latter, is 21 mm.

Fifth Pair—These are 65 mm. long, measured under standard conditions, with proximal articular widths of 18 mm. The epi-pleural processes are 15 mm. from the distal ends of the main ribs, and 22 mm. across the ribs and processes at their apices, and at their united base lines they measure 11 mm. across. The costals are 28 mm. long.

Sixth Pair—These ribs are 68 mm. long, with proximal articular measurements equal to 19 mm. The epi-pleural processes arise 18 mm. from the distal ends, and expand to 22 mm. at their tips, with the main ribs included. The costals are 35 mm. long.

Seventh Pair—These ribs have a length of 67 mm., and proximal articular measurements equal to 20 mm. The processes arise 18 mm. from the distal ends, and expand at their tips to 13 mm. The costals are 40 mm. long.

Eighth Pair—This and the succeeding pair of ribs were measured in situ upon the synsacrum, to which they were left attached for future reference. Their total length may be placed at 67 mm., with proximal articular widths equal to 22 mm. The processes arise 30 mm. from the distal ends, are but slightly developed, and measure 13 mm. across their tips, including, of course, the width of the ribs themselves. The costals are 47 mm. long.

Ninth Pair—These ribs are 67 mm. long, with proximal articular measurements equal to 21 mm. They develop no epi-pleural processes, but support costals 55 mm. long, which, as already stated, reach the sternum by direct articulation.

BONES OF THE PELVIC LIMB.

Femur. This bone has a total length of 126 mm., with a proximal width of 27 mm., and a distal width of 28 mm. The diameter of the shaft in its centre is slightly under 13 mm.

The trochanter major is highly pneumatic throughout, the actual pneumatic fossa being situated upon the convex pre-trochanterian surface, 14 mm. from the proximal end of the bone. The fossa, or foramen, is 6 mm. long and 3 mm. wide. There is no indication of a trochanter minor. The epi-trochanterian surface is wide and evenly rounded, passing with a very slight interruption into the head. Below, the constriction forming the neck is well defined; the upper third of the head is excavated for the ligamentum teres. The nutrient foramen is situated, as usual, upon the posterior surface of the shaft, and in this case 65 mm. from the proximal end.

The popliteal fossa is large, but very shallow; the fibular groove is deeply impressed, as is also the rotular channel. The

inter-condylar fossa is well marked; the ecto-condylar fossa is moderately large, and very deep.

Tibio-Tarsus.—This bone is 171 mm. long, with a proximal width, including the head of the fibula, of 29 mm. The anterior-posterior dimensions of the same, amount to 26 mm. Proximally the pro-cnemial crest rises to 5 mm. above the floor of the contained fossa, and the ecto-cnemial crest develops a hamular process. A large number of foramina penetrate the shaft within the first 50 mm. of its length, and during dissection blood continued to ooze from 13 such apertures. This enormous amount of vascular penetration into the substance of the shaft, as well as the extent to which all the muscles of the leg are supplied with blood vessels, must relate to the need for power in striking the natural prey of the bird, and the sustained drain upon the muscular power during the transit of the prey across long distances. The shaft of the bone is gradually flattened out as it approaches its distal extremity, the measurements in the centre being 12 mm. in diameter x 10 mm. in thickness, as against 15 mm. x 8 mm. immediately above the extensor bridge. The proximal half of the shaft is bent backwards, and twisted outwards, by which latter modification the ankylosed fibula describes an arc of a circle; this is in marked contrast to the almost straight tibio tarsus and fibula of the vulture. Distally both condyles are developed to an almost similar degree (the ecto-condyle being the smaller). The extensor bridge is 5 mm. wide, and is set at an angle of 70 degrees to a line drawn vertically through the centre of the shaft.

Fibula.—The fibula is free proximally, but ligamentously articulated by the head; then follows an open space 15 mm. long and 3 mm. wide; next an ossified tract 40 mm. long, succeeded by a second space 25 mm. long; lastly, a well ossified tract of 40 mm., after which the bone subsides upon the shaft of the tibia. A large nutrient foramen is situated immediately above the second space between the two bones. The head of the fibula measures 26 mm. x 7 mm.

Tarso-Metatarsus.—This bone is 118 mm. long, 22 mm. wide proximally, and 27 mm. distally. Owing to the even development of the condyles of the tibio-tarsus, as already noted, the articular cups show less disproportion in size than usual, and are almost upon the same level; that for the ecto-condyle is the larger and deeper of the two. There is a single tubercle for the attachment of the tibialis anticus, having a face of 8 mm. long. Unlike the similar attachment in the leg of the chestnut-faced owl, there is no tendency to form here a semi-ossified bridge. The two foramina, at the proximal end of the bone, left for the transmission of blood vessels through the shaft, are

extremely small, and will only just give entrance to an ordinary dissecting needle; long after dissection blood was found oozing from them. Below these foramina the shaft is thin to transparency, and upon the inner side bends round in a semi-circle to a feather edge. Externally the shaft is squared, and presents a flat surface, 13 mm. wide in its centre. Posteriorly, the tendonal canal commences by two distinct but shallow grooves, that are bordered by the two calcaneal processes, and after a passage of 30 mm. down the shaft they subside. The larger of the two processes is 11 mm. long. Upon the whole the groove is flat and wide, reaching at a point situated 30 mm. from the proximal end of the bone a width of 15 mm., while in the centre of the shaft (which is 13 mm. wide) it measures 9 mm. Distally the third un-ankylosed carpal, presenting an articular facet to the hallux, is 27 mm. long and 15 mm. wide at its trochlear surface. Trochlea No. 2 is the same width, viz., 15 mm., including the articular surface and styloid process; No. 3, is 8 mm. wide, and No. 4, 5 mm. wide (articular surface only). Trochlea No. 4 is drawn upwards 3 mm. from the common level of Nos. 2 and 3, while that of the hallux is 10 mm. higher still. The foramen for the passage of the anterior tibial artery is situated 17 mm. from the distal end of the bone, and through it a branch of the artery passes immediately through the bone, while at right angles to this foramen there is a second (as in the chestnut-faced owl), which transmits a tendon to the inter-trochlear space.

TOES.

Hallux*.—The first phalanx of this toe is a stoutly fashioned bone 40 mm. long, and proximally 17 mm. by 11 mm., while distally the measurements are 10 mm. by 10 mm. The articular surfaces are deeply impressed, and the processes and fossæ for ligamentous and muscular attachment are in keeping with the need for enormous raptoral power. The second phalanx is the ungual one—a bone that measures 44 mm. along its chord. Proximally it is 15 mm. by 12 mm. upon its articular surfaces, or 10 mm. if the process for the attachment of the erecting ligament is included.

*Note.—The measurements given for all ungual phalanges were made after the removal of the horny claw sheaths.

Second Toe.—The second toe consists of three bones, the proximal one being practically ankylosed to the succeeding one, and, although the latter phalanx was separated during dissection, it was only at the cost of a fracture of the under surface of the bone. The proximal phalanx is 16 mm. long, 18 mm. wide, and 12 mm. deep. The second phalanx is 33 mm. long,

12 mm. wide, and 12 mm. deep at the proximal end, and 10 mm. wide by 10 mm. deep at the distal end. The ungual phalanx measures 43 mm. along its chord, 11 mm. wide proximally, and 15 mm. deep upon its articular surfaces, or 18 mm. if made to include the process.

Third Toe.—This toe consists of four joints, the first one being 31 mm. long, 15 mm. wide, and 12 mm. deep proximally. Distally it is 9 mm. wide, and nearly 9 mm. deep. The next bone is 16 mm. long, 10 mm. wide proximally, and 11 mm. deep, with a distal width of 9 mm. and a depth of 8 mm. The succeeding phalanx is 30 mm. long, 10 mm. wide, and 9 mm. deep proximally, and 8 mm. wide by 8 mm. deep distally. The ungual phalanx measures 32 mm. along its chord, and at its articular end is 9 mm. wide and 9 mm. deep, or 12 mm. including the process.

Fourth Toe.—The measurements and dispositions of the five bones composing the fourth toe are as follow:—The proximal phalanx is 17 mm. long, 9 mm. wide, and 9 mm. deep proximally, and 8 mm. wide by 7 mm. deep distally. The next phalanx is 8 mm. long, 8 mm. wide, and 7 mm. deep proximally, and distally 7 mm. wide and 6 mm. deep. The third phalanx is 9 mm. long, 8 mm. wide, and 7 mm. deep proximally, and 7 mm. by 7 mm. distally. The fourth phalanx is 26 mm. long, 7 mm. wide, and 7 mm. deep proximally, and 6 mm. wide by 5 mm. deep distally.

The ungual phalanx of the fourth toe measures 28 mm. along its chord, and is proximally 8 mm. wide by 8 mm. deep, or 12 mm., including the process.

SYNSACRUM.

The synsacrum has a total length of 128 mm., including the pubic bones, and 115 mm. without them. The greatest width across the gluteal regions is 61 mm. The pre-acetabular length, measured along the outer walls of the ilia, and not therefore taken in a central line, is 70 mm. to the anterior rim of either acetabulum. If the synsacrum is inverted upon the measuring board, so as to rest upon the ilio-neural ridge, the greatest elevation of the pubic bones above the base board is 78 mm. Posteriorly the pubics curve inwardly, but do not quite meet one another by a space of 8 mm. In the adult condition of a synsacrum such as this it is not easy to state with certainty the exact number of vertebræ that enter into its composition, but apparently 14 or 15 are here involved. The gluteal ridges as they advance forward completely blend along the neuro-central line in the eagle, but in the vulture they retain their identity

throughout. Posteriorly viewed, the synsacrum of the eagle is angular, while that of the vulture is nearly square.

VERTEBRÆ.

There are 18 vertebræ between the skull and the synsacrum, and, if we allow 14 for the synsacrum, as in the chestnut-faced owl, the whole vertebral series will be the same in actual disposition, sequence, and numerical totality, since the caudal series of the eagle consists of 8 vertebræ—7 ordinary and the pygostyle—the pygostyle here consisting, apparently, of a single vertebra, and not of two, as in the owl. With this latter exception the vertebral series of these diurnal and nocturnal birds of prey exactly agree.

H. H. SCOTT,
Curator.

Launceston Museum, November 18, 1909.

THE "EXAMINER" & WEEKLY COURIER
LAUNCESTON TASMANIA

Victoria Museum, Launceston, Tasmania.

MEMOIR

ON

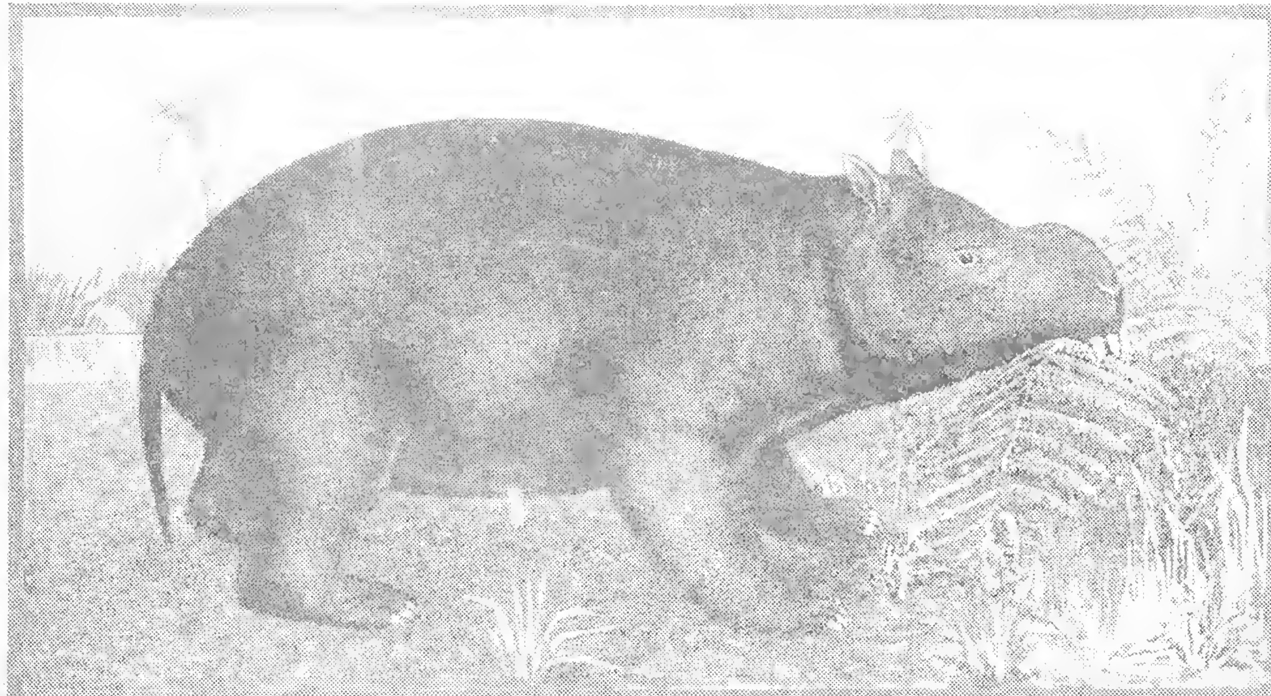
"Nototherium tasmanicum" (Owen)

(Museum Brochures, No. 4.)

With the Compliments of the Museum Committee.

Launceston Museum,
August 1912.

EXAMINER PRINT.



CONJECTURAL RESTORATION OF "NOTOTHERIUM TASMANICUM."

Introductory Note.

Nototherium tasmanicum was described by me in "The Tasmanian Naturalist" for April, 1911, the type of the species chiefly resting upon the distinctive structure of the humerus, the mandible, and characters of the tooth line. In the present brochure some osteological characters are added to those already detailed, and a recapitulation of such comments as have appeared since the creation of the species. The classification of this extinct gigantic marsupial is as follows:—

Order: Marsupialia.
Family: Nototheriidæ.
Genus: Nototherium (Owen).
Species: tasmanicum (S.P. Nov.).
Habitat: Tasmania. Extinct; skeleton in Launceston Museum.

With the exception of the remains from King Island, referred to in the text, which came to hand later, these are the only indications yet brought to light of the former existence of these animals off the present mainland of Australia.

H. H. SCOTT, Curator.

Launceston Museum,
August 20, 1912.

"Nototherium tasmanicum"

(Part 2.)

OSTEOLOGICAL AND COMPARATIVE.

By H. H. Scott, Curator of the Victoria Museum, Launceston.

In a paper in collaboration with my friend, Mr. K. M. Harrisson, I partly outlined through the pages of the Tasmanian Naturalist (1) the osteology of the first Nototherium discovered off the mainland of Australia. Although that paper did not profess to exhaust the subject, I hoped that I had supplied sufficient proof of the specific distinction of the specimen to justify the name conferred upon it, viz., "Nototherium tasmanicum."

In the following November, however, Dr. Fritz Noetling contributed a recapitulative paper to the Tasmanian Royal Society (2), in which he says:—"The characteristics on which this fourth species is established are altogether unsatisfactory." In this numeration of species Dr. Noetling is following the text of Jack and Etheridge's Palæontology of Queensland, and the species alluded to are as follows:

1. Nototherium mitchelli. (Owen's type.)
2. Nototherium inerme. (Owen.)
3. Nototherium dunense. (De Vis.)

And, lastly, my species, tasmanicum. But, as I pointed out in my paper, the species victoriæ of Owen should now be, in my opinion, number two upon the list, as it is pretty clear to-day that "inerme" was founded upon immature characters (3), and therefore it cancels itself; while victoriæ has some claim as a species, as I yet hope to show.

In his Catalogue of the British Museum Fossil Mammals, Vol. 5, Lydekker merges victoriæ into the type, upon the grounds

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(1) The Tasmanian Naturalist, Vol. 2, No. 4, April, 1911.

(2) The occurrence of gigantic marsupials in Tasmania. Royal Society, Nov. 14, 1911. By Fritz Noetling, M.A., Ph.D.

(3) It is only fair to state that Professor Flower considered the species inerme was founded upon a mandible that had been broken off at the symphysis, and afterwards so ground down that the sockets of the tusks had been obliterated. Vide Cat. Ost. Royal Col. Surgeons, page 732.

that the characters upon which Professor Owen founded the species were merely individual. Now, if this were true, the chances against another specimen being discovered possessing these characters are enormous. Yet our second Nototherium, recovered from a drained swamp in King Island, reproduces typically the very characters that Professor Owen founded his species upon!

The information yielded by a study of these bones establishes two points of some importance to us, viz.:

(1) That by the commonly accepted standards of classification Professor Owen's taxonomy was sound in the creation of this species:

(2) That in dealing with the classification of the extinct Nototheria we now have a limit to the value of individual variation, and anything as pronounced as the characters of N. victoriæ cannot be fairly ruled out as individual variations.

As it is outside my present purpose to continue this subject, I shall only say that any characters claimed by me for the species tasmanicum are more pronounced than those hitherto ruled out as individual variations in the instance of Nototherium victoriæ.

FEMUR.

Professor Owen's type skeleton of Nototherium mitchelli did not include a femur among its fossil remains; but five years after his description appeared a distal end of one came to hand, and its characters were duly detailed in the Journal of the Geological Society.* This bone included the distal condyles, and as much of the shaft as went to make up a total length of 216 mm., and in dealing with the complete femur I shall call this point of the shaft "Owen's line."

The femur of Nototherium tasmanicum has a fairly smooth shaft, almost completely oval in section, and quite unlike that of N. mitchelli (see comparative outlines). The head surmounts a short neck set at an angle to the main shaft of 40 degrees, and is so absolutely round as to give equal diameters in all directions. The trochanter major gives expansive surface for muscular attachment, and is pierced by an oval trochanterian fossa, 51 mm. x 32 mm. in size, penetrating the bone (at an angle of 20 degrees to the centre of the shaft) to a depth of 38 mm. The second and third trochanters are indicated by cicatrices, the latter being an oval scar 50 mm. x 40 mm. Distally — and therefore comparatively — the ecto and ento-condyles are larger than those of N. mitchelli, while the intercondylar fossa is less extensive. The condyles also

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* Journal Geo. Society, Aug., 1882, page 304.

differ in shape, while the manner in which the shaft in the neighbourhood of the ecto-condyle rises above them is markedly different. Indeed, compared with this type, the essentially different sectional shapes of the two femora supply various specific contrasts, as might be expected.

COMPARATIVE FEMORA.

	N. mitchelli.	N. tasmanicum
Breadth across condyles	145 mm.	153 mm.
Breadth of shaft section at Owen's line ..	77 mm.	85 mm.
Antero posterior section at Owen's line ..	56 mm.	52 mm.
Circumference of ditto at Owen's line	212 mm.	220 mm.
Circumference above condyles	309 mm.	381 mm.
Circumference including condyles	Not stated	451 mm.
Breadth of rotular joint	56 mm.	80 mm.
Breadth of intercondylar fossa	35 mm.	10 mm.
Greatest length of femur	Not given owing to mutilation	475 mm.
Greatest width between two vertical walls		204 mm.
Girth of shaft at lower edge of the trochanterian fossa	.. ..	420 mm.
Girth below head	.. ..	251 mm.
Diameter of head, in all directions	.. ..	83 mm.
Length of neck	.. ..	63 mm.
Thickness of shaft, at trochanter major ..	.. ..	65 mm.
Distance from top of trochanterian fossa to epi trochanteran surface..	.. ..	25 mm.
Distance from head to trochanter minor ..	.. ..	178 mm.
Distance from head to nutrient foramen ..	.. ..	152 mm.

Starting from the inner edge of the ento-condyle, a spiral muscular groove ascends the shaft, finally losing itself upon he inner edge 150 mm. from its source.

The "ligamentum teres" was apparently missing, as there is no depression in the head for its insertion, and in this the animal agrees with the extinct ground sloth and Dinoceras, as also the living elephant, sea otter, seal, orang utan, and the monotremata.

The other parts of the skeleton—the scapulæ, vertebræ, ribs, and pelvis—are not here detailed, but are available at any time for comparison. In a general way, it may be stated that the evidence yielded by a study of the skull, mandible, femur, humerus, calcaneum, and astragalus, are solid evidence enough for the specific distinction of the Tasmanian animal from either of the mainland types.

THE HUMERUS.

As much of the weight of my classification was thrown upon the humerus, so that this bone was practically elevated to the position of a specific type, I would like to extend the study of this important part of the skeleton prior to entering upon the osteology of the skull. From certain private correspondence that has

passed between Dr. Noetling and myself respecting the classification of Nototheria, I gather that the learned Doctor doubts the value of specific characters impressed upon the humerus of either our special Nototherium, or else of such in animals generally; but a careful study of the humeri of any sequence of animals—accepted as being specifically distinct—will quickly show that the correlated modifications of skull and shoulder girdle do most strongly and emphatically manifest themselves upon the humeri. In this connection I would cite the case of elephants, living and extinct, heading the list with Palæomastodon and ending with the two species of modern elephants.

HUMERI OF ELEPHANTS, LIVING AND EXTINCT.

1. Palæomastodon. Humerus with curved shaft, high swelling deltoid regions, supinator ridge low upon the shaft.

2. Elephas Primigenius. Shaft more symmetrical, deltoid still high but less abrupt, supinator ridge ascending higher up the shaft.*

3. E. meridionalis. Deltoid coming down the shaft, supinator better defined, and approaching it.

4 and 5. The humeri of the two modern elephants vary chiefly in the deltoid regions, asiaticus being more pronounced, and the shaft wider proximally. The humerus of Nototherium tasmanicum departs from that of N. mitchelli in exactly the same way as elephas primigenius and E. meridionalis depart from one another, and incidentally from Palæomastodon.

Coming to closer quarters, and in defence of my table of measurements already published, I herewith append a comparative study of the ratios of the humeri of Nototheria and wombats, which, according to Lydekker, probably diverged from a common ancestor:

In N. mitchelli the humerus has a distal width in relation to length in the ratio of	28 to 50
In N. tasmanicum the same ratios give	22 to 58
In the extinct King Island wombat	21 to 47
In the Tasmanian wombat	24 to 57

* At page 252 of Brit. Foss. Mam., Prof. Owen says:—"It manifests the specific distinction of the humerus of the mammoth in the relatively shorter proportion of the great supinator ridge," thus giving to such characters the exact value I claimed for them in the establishment of my type humerus.

These ratios are curious and interesting, since they draw the Tasmanian wombat nearer to the Tasmanian Nototherium than they do to the King Island wombat, which is exactly what might be expected if food, climate, and environment generally have been the chief factors in the segregation of these species. But if now the same bones are compared proximally, in a similar way, we get the following data:

Humerus of N. mitchelli, ratio of width to length ..	15 to 50
Ditto N. tasmanicum, ditto ditto	16 to 56
Ditto King Island wombat, ditto ditto	25 to 72
Ditto Tasmanian ditto, ditto ditto	20 to 54

Here, again, the Tasmanian Nototherium approaches our specifically distinct wombat more than it does the King Island form, and my only regret is that the humerus of the King Island Nototherium cannot be included in this list. This great desideratum is impossible, however, since the bone was not in the matrix so carefully investigated by Mr. F. H. Stephenson, to whom we owe the discovery of these valuable remains.

A little reflection upon the above ratios will strengthen the conviction as to my correctness in the specific determination of Nototherium tasmanicum, since the other three animals are accepted as being good and true species upon an authority beyond all reasonable doubt.

Owen and Lydekker both state (and Owen's figures prove) that the humerus of N. mitchelli closely approaches that of the modern wombat, except that the deltoid is double and the entocondyle is flatter. It is easy to prove that in the matter of muscular ridges and processes the humeri of wombats do not show any great variation, and certainly nothing equal to that manifested by the type humeri of N. tasmanicum, whose characters with regard to deltoid, pectoral, and supinator supply the material for the construction of a humerus intermediate between N. mitchelli upon the one hand and the modern wombat upon the other.

Lastly, this Tasmanian humerus, in spite of its great length, in which it exceeds the type mitchelli by 67 mm., is so reduced in width as to fall below the type to the extent of 49 mm. This reduction in width means much less surface for muscular attachment generally, while the areas usually allotted to the attachment of pronator radii, flexor carpi radialis, and flexor carpi ulnaris, as also extensor carpi radialis, extensor carpi ulnaris, etc., etc., are both relatively and actually much smaller than those of the type.

NOTE.

Before passing in review the skull characters of Nototherium tasmanicum, I wish to say a word upon the King Island specimen. In my published paper I stated that I would like to see Nototherium victoriæ again elevated to the rank of a true species, little thinking that in about a year the material with which to open up the question would be in my hands. But having shown (supra) that Prof. Owen's specific characters re-appear in the King Island animal, the interesting question of geographical distribution naturally crops up.

The bones upon which the species N. victoriæ were founded came from the shores of Lake Victoria, about 400 miles as the crow flies from the grave of the King Island animal, but upon the very line that the last land bridge between that island and the mainland evidently extended. All sciences have contributed data to prove that the present-day fauna on King Island approaches much more closely to that of the mainland than it does to the essentially insular fauna of Tasmania (always using these words with regard to a limited range in time as respecting isolation. And in this connection the fact may be recalled that even the King Island emu approached more closely to the Kangaroo Island bird than it did to the Tasmanian or mainland form. The time is not ripe for much speculation about this last land bridge, but one cannot but ask, Is there a hint here respecting pleistocene faunal distribution? Or is the likeness between the King Island Nototherium and that of Lake Victoria, and the King Island emu and that of Kangaroo Island of no geographical importance? Dr. Noetling has published a chart setting forth his views upon the question of these old land bridges, but does not carry his lines west of Cape Otway. Although, of course, largely speculative, this chart is of much value, and should be consulted by those interested in such matters.

Also, in "Memoir No. 3" of the National Museum, Melbourne, Prof. Baldwin Spencer ably deals with the land bridge between Australia and King Island, showing that a river ran through the north western part of it, traversing low ground, while the present King Island was the mountain table land of that day.

Widely considered, it is obvious that with Diprotodont remains cropping up at Colac (as recorded by Prof. McCoy), and at King Island and Lake Victoria, and closely similar birds at King and Kangaroo Islands, we are in possession of four cardinal points with which to start a land reconstruction chart.

But whatever the land bridge may have been, certain it is that it broke earlier between King Island and Tasmania than it did between King Island and the mainland, or else King Island

longer retained the mainland climatic conditions, since all our fauna shows specific or varietal modifications. In the creation of a new species of Nototherium this last factor weighed heavily with me, since, in addition to the structural data supplied by a study of the Smithton remains, I was dealing with a creature coming from a province that has been abundantly proved to be an area of isolation during a considerable period of time, and not with a merely roaming animal, moving from one part of a vast continent to another. These Nototheria, over specialised and largely doomed upon the mainland, avoided immediate extinction by migration into Tasmania, and the geographical and climatological changes thus induced manifested themselves in the direction zoological science accepts as specific departure. Personally, I claim that here the Nototheria remained, living under the more favourable conditions supplied by this isolated province until long after their extinction upon the mainland, and thus acquired the taxonomic distinction manifested by all our native animals. Dr. Noetling objects that since the Tasmanian natives knew nothing of these animals, they could not have survived down to the human period. But as the whole of our information respecting the personal knowledge of the lost Tasmanian race is so meagre, this objection can hardly hold good, especially as the knowledge of the survival of the Glossotherium to the human period in South America only dates from 1902, in spite of our long and extensive knowledge of the South American races generally.

COMPARATIVE OSTEOLOGY.

Among other elements, the King Island Nototherium supplied the right calcaneum and astragalus, and as the left calcaneum and astragalus are present in the Tasmanian specimen, an interesting study of the little known subject of the feet of these gigantic creatures is thus supplied. Space forbids the inclusion of my notes upon these heel and ankle elements into the present text.

POSE.

The articular facets and the smooth shafts of the femora of the Nototheria suggest that the hind legs of the creatures were capable of such flexion at the knees as would bring these bones to an angle of at least 70 degrees, although less was perhaps the normal position. No especial strength was centred in the hind-quarters, as obtained in the ground sloths, but the freely rotating forearm and drag-hook like tusks were evidently correlated factors in the search for food.

THE ILLUSTRATION OF THE SKULL.

The skull when recovered was very badly broken, and had apparently been so mutilated prior to its inclusion in the matrix. Accordingly, it was slowly dried in a dark room during several months, the whole of the thirty-six pieces being strengthened with glue. In spite of every care, however, some slight crumbling along the fractured edges was found to be unavoidable, and in restoring the skull no attempt was made to force the parts together, the idea being rather to outline the cranium as a whole. The slight overlap in the orbital regions and the defective angle of the right jaw are of small importance, since the first is obvious and can be allowed for, while the left ramus, although broken off at the third molar, is perfect in the posterior regions, and has been set up separately to assist in the study of the condyle and coronoid process. Fig. 5 of my last paper shows the mandible with its several imperfections as recovered from the matrix.

SKULL.

According to Professor Owen, the skull of the Nototherium is shorter in proportion to its depth and width than that of the Diprotodon, and differs from the latter in the way in which the maxillary or facial portion of the skull is bent up upon the cranial portion, and in the angle made by the palate, with the basis cranii. Since this description was written it has been shown that the type skull of the Diprotodon referred to was incorrectly restored to the extent of four inches, and therefore the first contrast noted hardly holds good. All the rest of the characters are absolutely correct. This alteration also reduces the likeness claimed by Professor Owen to exist between the Diprotodon and the kangaroo, and brings the former animal nearer to the existing wombat, and incidentally nearer to the Nototherium also.

As will be seen by a glance at the illustration, the skull is very massive, and nearly as wide as it is long, the zygomatic arches standing away from the cranium to a distance of 130 mm., and, armed with pre-massiter attachment processes, make the skull extremely powerful in this region, and constitute one of its chief generic characteristics. The maxillo-nasal part of the skull is sharply bent up upon the cranium, the fronto nasal suture being ankylosed to extinction. The nasals are wide, and completely roof over the nasal cavity, the maxillary moieties being restricted to the outer edges instead of contributing to the roof of the cavity as in the wombat. As thus constituted, these maxillary moieties form two bony processes standing out from the face line at an angle of 60 degrees. The pre-orbital foramen is nearly round instead of being cuniform as in the wombat, its size suggesting a

movable snout during life. The mandibular dental foramen is much lower down than obtains in the skulls of wombats. In life during normal occlusion the lower tusks operated against the small incisors of the upper jaw.

MEASUREMENTS.

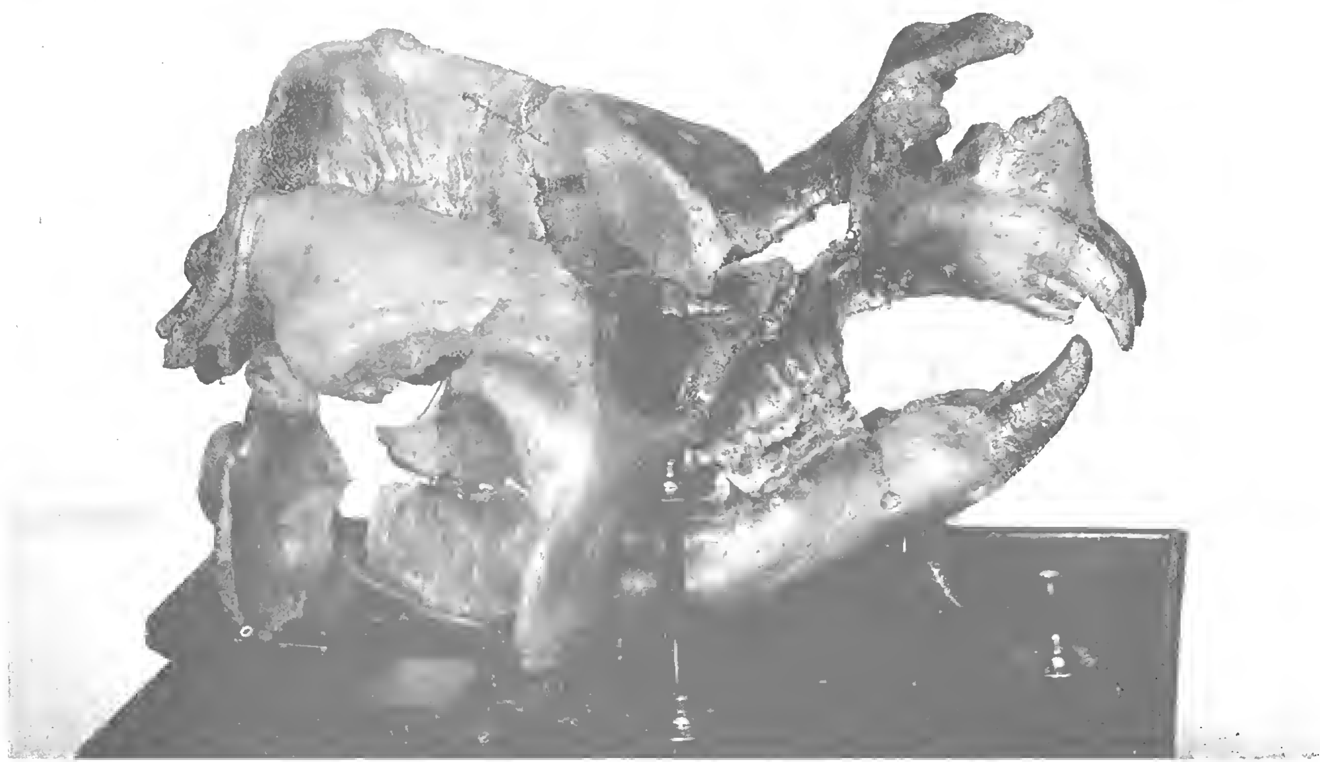
Total length: 520 mm.

Greatest width: 420 mm.

Width of supra-occipital bone: 325 mm.

The above should be taken in conjunction with the data already published in "The Tasmanian Naturalist."

In addition to the mandibular characters already published in detail, the skull departs from the type in various ways, chiefly in the enormous elongation of the facial in proportion to the cranial part of the head, this being consistent with the elongated symphysis already noted as a specific character of N. tasmanicum. As minor points, the production of the nasals to a greater extent, the wider divergence of the tusks and method of insertion of the same, together with the different shape of the mandible, all furnish characters of comparative importance. Less stress has been laid upon tooth structure, since these obviously vary enormously in individuals, but such correlated variations as an elongated chin and shoulder girdle are of deeper meaning.



SKULL OF "NOTOTHERIUM TASMANICUM."

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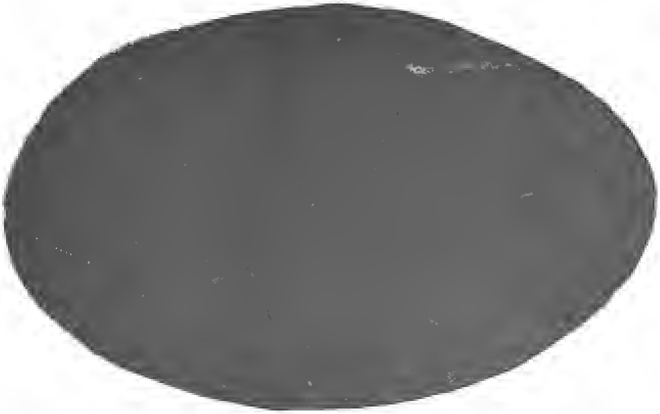
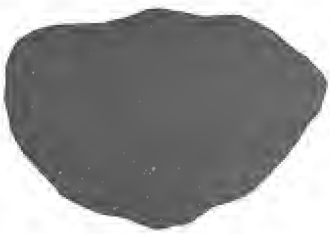
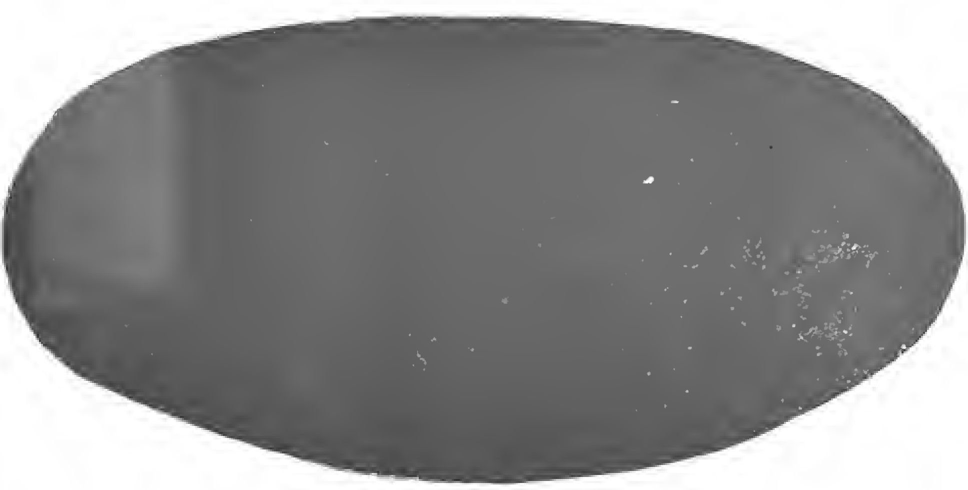
Comparative Femora.



SECTIONAL OUTLINE OF SHAFT OF FEMUR OF "NOTOTHERIUM TASMANICUM." (FULL SIZE.)



SECTIONAL OUTLINE OF FEMUR OF "NOTOTHERIUM MITCHELLI." (HALF SIZE.)
(PROFESSOR OWENS' TYPE SPECIMEN.)



SECTIONAL OUTLINE OF SHAFT OF FEMUR OF DIPROTODON, SP.,
(SPECIMEN FROM DARLING DOWNS.) (FULL SIZE.)

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Victoria Museum, Launceston, Tasmania.

MUSEUM BROCHURE
No. 5

Some Notes on the Humeri of Wombats

WITH THE COMPLIMENTS OF THE MUSEUM COMMITTEE.
LAUNCESTON MUSEUM, JAN. 1915.

14,025—EXAMINER

Introductory Note.

Incidentally when dealing with the humeri of the Nototheria, I found that the extinct King Island wombat had an exceptionally long and narrow humerus, quite unlike that of any existing species. A similar type of humerus recently sent to the Museum by Mr. E. C. Clarke, of Mole Creek, Tasmania, closely simulates this upper arm bone of the extinct King Island animal. From the Limestone Caves, that furnished the latter, Mr. Clarke recovered a single humerus that agrees very closely with the same bone in the skeleton of the hairy-nosed wombat of South Australia.

As the narrow wombat humeri agree in general contour with those of Nototherium tasmanicum, and the humeri of the living Tasmanian, mainland, and Flinders Island wombats reproduce characters nearer to those of the so-called humerus of Nototherium mitchelli, I have decided to publish figures of these several bones.

As fully discussed in my Memoir upon Nototherium tasmanicum, issued by the Geological Survey of Tasmania, the humerus relegated to Nototherium mitchelli is open to question.

These comparative notes, however, tend to prove that future discoveries may show, that a long narrow type of humerus, and a short wide one, obtained among the extinct Nototheria, as it does among the more recent wombats.

H. H. SCOTT.

Museum, Launceston, January, 1915.

The Humeri of Various Wombats.

Before attempting to discuss the osteology of the specimens I propose to deal with, it will be necessary to call attention to the somewhat similar work detailed in Memoir No. 3 of the National Museum, Melbourne, compiled by Prof. Baldwin Spencer, F.R.S., and Mr. J. A. Kershaw, F.E.S. This paper will be the only one I refer to in the present text, as it is the only one that in any sense covers similar ground. The main object of the paper cited was to exhaustively emendate the existing classification of wombats, and to establish specific distinction for the wombat of Bass Straits Islands, as also for that commonly found in Tasmania. Inter alia, the authors listed comparative measurements of various humeri, but did not make quite the same special study of the King Island wombat humeri that I intend doing here. My notes are chiefly the outcome of certain comparative studies conducted among the extinct gigantic Nototheria. The recent discovery (1915) of wombat remains in Tasmanian caves, that closely simulate similar specimens from King Island, obviously establish a line of departure from that so clearly laid down by the authors abovenamed. About a year after the publication of the National Museum Memoir, I was making extensive comparative notes upon Nototheria and wombats, and was much struck with the fact that all the humeri of King Island wombats that had passed through my hands were, without any exception, long and narrow, with extended pectoral ridges, and deltoids high up the shafts. As far as is known to me, with the exception of these humeri just found in the Limestone Caves at Mole Creek, Tasmania, such bones are not at present obtainable from any other sources.

Plate No. 1, Figures 1 to 4 inclusive, depict King Island humeri of various stages of growth. Figues 5 to 6 inclusive give a similar series from the Mole Creek Caves of Tasmania. These photographs are sufficiently good to show the striking similarity of the two sets of bones.

Plate No. 2 is arranged to contrast the narrow and the wide type of humeri.

Figure 1 is a wide humerus from the existing Flinders Island wombat.

Figure 2 is a narrow humerus from Mole Creek.

Figure 3 is a similar specimen from King Island.

While Figure 4 is an immature, wide type of humerus from the existing wombat of Tasmania.

Plate No. 3 is of special interest, as the two humeri, one femur, and the two rami of the mandible of an extinct (immature) wombat, are all supplied by a single animal. These associated bones carry the numbers 1 to 5 inclusive.

Numbers 6 and 7 are two non-associated rami of King Island wombats, of approximately similar size. The King Island jaws, however, seem of greater age.

Plate No. 4 illustrates a heavy wombat humerus from the Mole Creek Caves that closely simulates the humerus of P. latifrons, of South Australia.

Here Figure 1 is the Tasmanian bone, and Figure 2 the hairy-nosed wombat's bone. This latter was kindly supplied to me by Mr. Edgar R. Waite, Director of the Adelaide Museum. My aim in setting out these facts is more comparative than taxonomic, and is intended to show that wide and narrow humeri obtained among wombats recent, and extinct, and possibly did so obtain among the extinct gigantic Nototheria. If this latter is eventually proved, then Prof. Owens' relegation of a fragmentary platyrhine type of humerus to Nototherium mitchelli may be vindicated.

I supply a table of comparative measurements for all the humeri illustrated in the present text.

Recapitulative.

It would thus appear that in Northern Tasmania, as well as upon King Island, a narrow humeral type of wombat once existed. Also, if the evidence of a single humerus cemented to the floor of a limestone cave at Mole Creek be accepted, that Tasmania formerly served as a habitat for a wombat with approximations to the latifrons type of South Australia, the super-ossification of the pectoral ridge of the Tasmanian humerus being practically the only difference between the two bones (Vide Plate No. 4). All the humeri from King Island that have come my way agree in having long, narrow shafts, irrespective of age; and similarly all Mole Creek humeri yet recovered are of this type (irrespective of age) with the single exception of the latifrons bone noted supra. All Flinders Island and Tasmanian humeri examined by me agree with the mainland platyrhine type. It must, however, be pointed out that Messrs. Spencer and Kershaw figure (loc. cit. plate xi., fig. 13) a platyrhine type of humerus as being a King Island specimen, so obviously there is room for extended research here. These narrow wombat humeri make a distinct approach to the upper arm bones of the phalangers and phascolarctus, and in my opinion are of considerable phylogenetic importance.

PLATE No. 1.

King Island and Mole Creek Wombat Humeri.

No.	Locality.	Total Length	Distal Width	Proximal Width	Epiphyses.	General Condition.
1	King Island	112 m.m.	36 m.m.	23 m.m.	Nearly closed	Distally good: rubbed proximally.
2	King Island	110 m.m.	37.5 m.m.	23 m.m.	Closed	Rubbed at both ends.
3	King Island	75 m.m.	24 m.m.	17 m.m.	Open	Rubbed proximally: distally perfect
4	King Island	75 m.m.	24.5 m.m.	16.5 m.m.	Open	Rubbed proximally; distally perfect.

Mole Creek.

No.	Locality.	Total Length	Distal Width	Proximal Width	Epiphyses.	General Condition.
5	Mole Creek, Tas.	118 m.m.	33 m.m.	24 m.m.	All missing	Reduced in length by loss of epiphyses.
6	Mole Creek, Tas.	114.5 m.m.	30 m.m.	23 m.m.	All missing	Reduced in length by loss of epiphyses.
7	Mole Creek, Tas	75 m.m.	21 m.m.	15.5 m.m.	All missing	Reduced in length by loss of epiphyses.
8	Mole Creek, Tas.	81 m.m.	24 m.m.	17.5 m.m.	All missing	Reduced in length by loss of epiphyses.

PLATE No. 1.

PLATE No. 2.

Comparative Wombat Humeri.

No.	Locality.	Total Length.	Distal Width	Proximal Width.	Epiphyses.	General Condition.
1	Flinders Island	95 m m.	39.4 m.m.	33 m.m.	Open	Good. Specimen recent.
2	Mole Creek, Tas.	121.5 m.m	38 m.m.	25 m m.	Lost	Reduced in length by loss of epiphyses.
3	King Island	115 m.m.	36 m.m.	23.5 m.m.	Proximal lost	Distally perfect.
4	Tasmania	95 m m.	48 m.m.	34 m.m.	Open	Good. Specimen recent.

1 2 3 4

PLATE No. 2.

PLATE No. 3.

Humeri, and other Wombat Bones.

No.	Locality.	Total length	Distal Width	Proximal Width	Epiphyses	General Condition.
1	Mole Creek, Tas.	Humerus 90 m.m.	27 m.m.	18 m.m.	All lost	Imperfect in length
2	Mole Creek, Tas.	Assoc. femur 112 m.m.	27 m.m.	35 m.m.	Open	Slightly imperfect.
3	Mole Creek, Tas.	Assoc. humerus 90 m.m.	27 m.m.	18 m.m.	All lost	Imperfect in length.

Mandibular Rami.

No.	Locality.	Total Length	Depth incl. teeth (central)	Height of the Coronoid	Height of the Condyle	General Condition.
4	Mole Creek, Tas.	115 m.m.	32 m.m.	Imperfect	Imperfect	Much mutilated.
5	Mole Creek, Tas.	1[illegible]8 m.m.	32 m.m.	Imperfect	56 m.m.	Coronoid mutilated.
6	King Island	112 m.m.	30 m.m.	Imperfect	Imperfect	Much mutilated.
7	King Island	114 m.m.	31 m.m.	Not quite perfect—40 m.m.	55 m.m.	Angle and Coronoid mutilated.

NOTE.—Numbers 1 to 5 inclusive are associated bones.

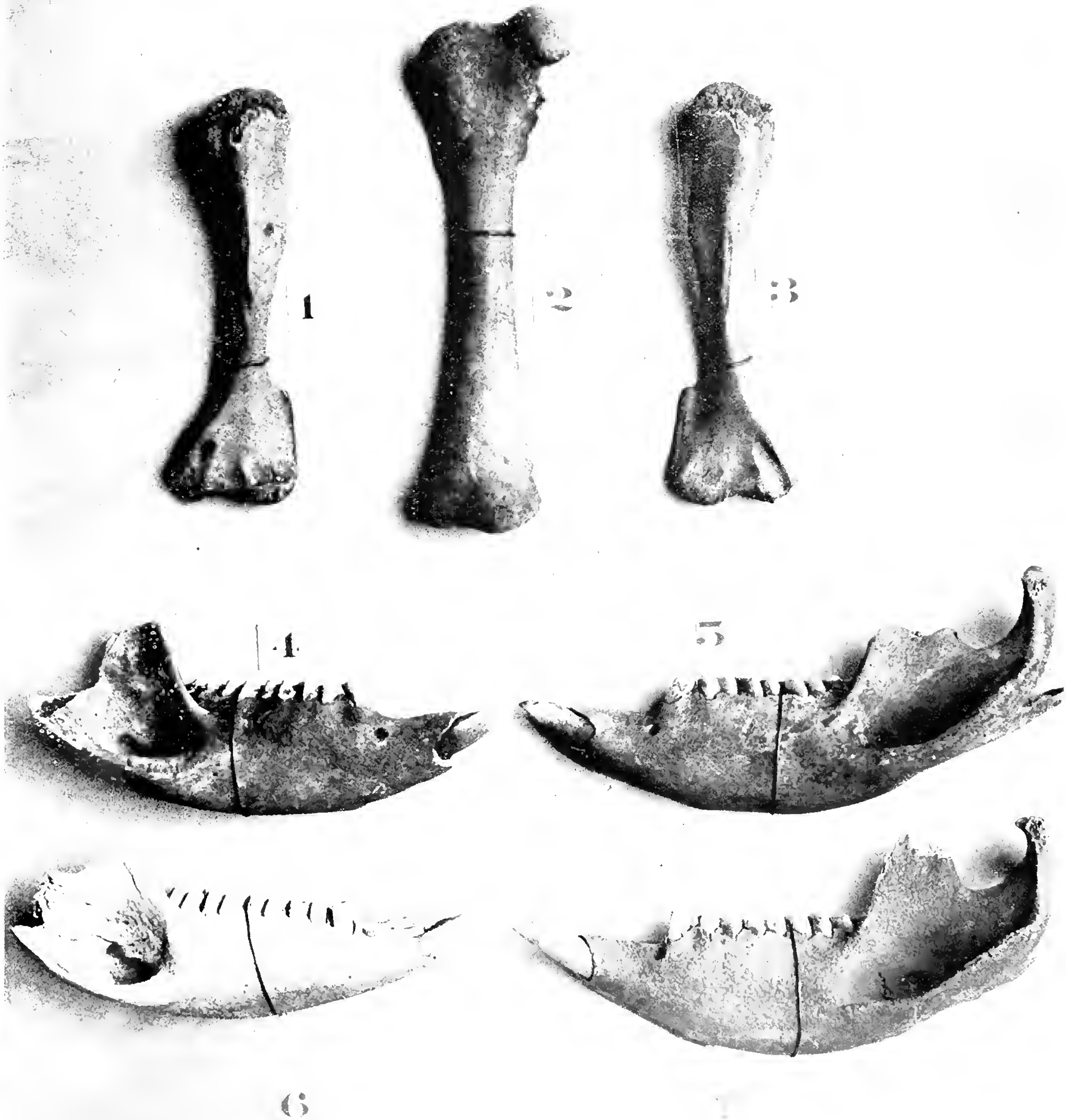

PLATE No. 3.

PLATE No. 4.

Comparative Wombat Humeri.

No.	Locality.	Total length	Distal Width	Proximal Width	Epiphyses.	Condition.
1	Mole Creek, Tas.	113.5 m.m.	47.5 m.m.	36 m.m.	Closed	Perfect.
2	South Australia. Hairy-nosed wombat humerus	1[illegible]5 m.m.	48.5 m.m.	38 m.m.	Closed	Perfect.

NOTE. Specimen No. 1 more closely approaches that of No. 2 than it does the humerus of P. Mitchelli.

1

2

PLATE No. 4

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TASMANIA.

Victoria Museum, Launceston, Tasmania

MUSEUM BROCHURE
No. 6

Some Palæontological Notes

(Largely Emendatory.)

WITH THE COMPLIMENTS OF THE MUSEUM COMMITTEE,
LAUNCESTON MUSEUM, MARCH 1917.

21209-EXAMINER PRINT.

Sthenurus atlas (Owen).

On the 6th of November, 1906, I published, as the second of the Museum Brochures, a short account of a mutilated cranium discovered by Mr. James McKie Bowling, at Surprise Bay, King Island. After detailing its various osteological characters, and illustrating the specimen by two photo. process blocks, I ventured to provisionally classify it as being a small species of Procoptodon with a bias in favour of its being "Procoptodon rapha" of Owen. At this time I was quite unable to refer to Professor Owen's original paper, and based my conviction of its being a Procoptodon upon Lydekker's statement that the mandibular symphysis of Sthenurus is not ankylosed (vide Cat. Foss., Mamm., Brit. Mus., Vol. 5, Page 232), while that of Procoptodon is ankylosed in the adult condition (loc. cit., Page 233). As the cheek teeth of our specimen were indicative of immaturity, while the jaws were ankylosed, I simply regarded this as an illustration of early super-ossification; but, as will be seen presently, Mr. L. Glauert has arrived at quite another conclusion. When working up a new Register in 1910, I recorded the following emendation:—"This fossil is a species of Sthenurus, and my former classification, based upon the ankylosis of the mandible alone, is, I fear, no longer tenable." The fossil appeared in our exhibited collection as a species of Sthenurus, and was duly listed as such. In September, 1915, my Committee authorised the loan of this specimen to the Western Australian Museum, to enable Mr. Glauert to make an exhaustive study of the cranium in comparison with his type skull of "Sthenurus occidentalis," and when returning the loan he reported as follows:—"I am much obliged to your Trustees for the opportunity of examining the most perfect cranium of Sthenurus atlas in existence. Our specimen of S. occidentalis is much more complete, and exhibits features absent from your skull. I think you were correct in changing the name from Procoptodon to Sthenurus, as the former is merely a synonym of the latter." In the same letter Mr. Glauert gives reasons for a personal conviction that the lower jaws of our specimen really belong to an older animal. In this connection, I have since gone over all old notes, and personally debated the point with Mr. Bowling as to the finding of the bones, and the evidence is such that a mixing—in so hard a matrix—of

parts of two skulls together would be little short of a miracle, since absolutely nothing but the skull, mandible, and part of a femur were found juxtaposed in an otherwise barren matrix! When the field notes and those of the comparative anatomist are at variance, obviously, the correct attitude is that of suspension of judgment, which attitude does not reflect upon Mr. Glauert's careful work. The main object of this present note is to accredit King Island with "Sthenurus atlas" of Owen (upon the determination of Mr. Glauert), and also to intimate to others working in this field of science that a characteristic specimen of this little-known animal is available for comparison, at a more accessible centre, for Australians, than the British Museum type.

Phascolomys latifrons (Owen).

In Museum Brochure No. 5, published in January, 1915, I recorded and figured a humerus of a wombat from Mole Creek Cave that practically reproduced the typical humerus of the South Australian hairy-nosed wombat. Quite recently (February 9th, 1917) I received from Mr. F. Henwood the distal end of a similar humerus from a cave at Flinders Island.

As Mr. L. Glauert, in 1912, recorded the discovery of fossil remains of this animal in Western Australia (vide Records of W.A. Mus., Vol. 1, Part II., Page 52), it would appear that its range in past days was far more extensive than at present, since to-day it is restricted to South Australia.

Phascolomys ursinus (Shaw).

(Reconstructed by Spencer and Kershaw, Mem. Nat. Mus., Melb., 1910.)

In November of last year (1916) a skull of the Straits Island wombat was found by Mr. S. Riddle on Cape Barren Island, and through the kindness of Mr. L. L. Waterhouse, of the Tasmanian Geological Survey Department, was presented to our Museum.

The wombat has been extinct upon Cape Barren Island for years, and the finding of this skull so far constitutes a new discovery, since no specimen from that locality has been hitherto recorded, or found its way into any Museum collection.

Gigantic Pleistocene Marsupials.

As our extinct faunal list of giant mammals now includes Tasmanian specimens of the genera Nototherium, Palorchestes, and Phascolomus, an attempt has been made to give pictorial evidence of this interesting item of natural history. All restorations are tentative, and constantly liable to—even drastic—emendations with advancing knowledge, but I think they serve a useful purpose in awakening an interest in such branches of science as they directly relate to.

Many valuable specimens would have been thrown unheeded to the void but for a prior interest having been aroused in the mind of the finder by the contemplation of restorations. Although, upon the whole, roundly denounced by most scientific men, their utility cannot be denied in toto, and, acting upon such a belief, I called in the services of Mr. Victor Henry to make a sketch introducing the three animals above named. It will be noted that the head of the Nototherium has been re-sketched since the publication of Mr. Henry's former picture, and of this action it may be said:—

1. Although it cannot be shown that anything in the nature of cerato-phoral epiphyses ever existed upon the nasal bones of Nototherian skulls, or even that the nasal bosses were manifest beyond the skin line, yet such states were possible.

2. As Prof. Watson strongly advocated the latter idea, its inclusion into the present sketch has been decided upon.

3. Whatever changes are made between the forehead and the tip of the nasals of a Nototherium in any restoration whatsoever, they must include a heavy, incipient, trunk-like upper lip as an essential appendix.

If the modern hippopotamus had never been seen alive by man, would-be restorers of this animal's outline would naturally group their ideas around the two following hypotheses:—

1. That the roughened maxillo-maxillary bosses were clad in leathery skin, and it might even be contended they were used as fighting bosses, also that the intervening fossae were manifest as factors of the facial contour. Now, such a contention is not extravagant, particularly when we remember that the said fossae are 50 m.m. deep, and about the same width across.

2. Again, others would as stoutly maintain that the roughened bosses were simply incidental to the alveolar requirements of the tusks, in the first place, and, in the second, to the needs of muscular aponeuroses, relating to the face and lips. Upon this second hypothesis, the outline of the face would be uninfluenced by the fossae, extensive though they be. The latter we know to be correct, as the animal is here to prove it. These imaginary instances exactly reproduce the conditions under which we attempt to restore the head of a Nototherium to-day. Deciduous epiphyses of ceratophoral import may have existed, or the roughening may have simply referred to muscular aponeurotic conditions.

As it is fairly certain that the Nototheria survived the Ice Age, and that they were to our fauna what Tichorhinus was to that of Europe, it will be noted that a heavy hairy coat has been added to the animal in the picture. Lastly, the fact may be recalled that all tapirs, living and extinct, and all rhinoceroses, living and extinct, so intergrade in their various characters that the teeth alone serve to distinguish them the one from the other. Nototherian teeth are more tapir-like than rhinoceros-like.

H. H. SCOTT,
Curator.

Victoria Museum,
Launceston, Tasmania,
March 26, 1917.

RESTORATIONS.

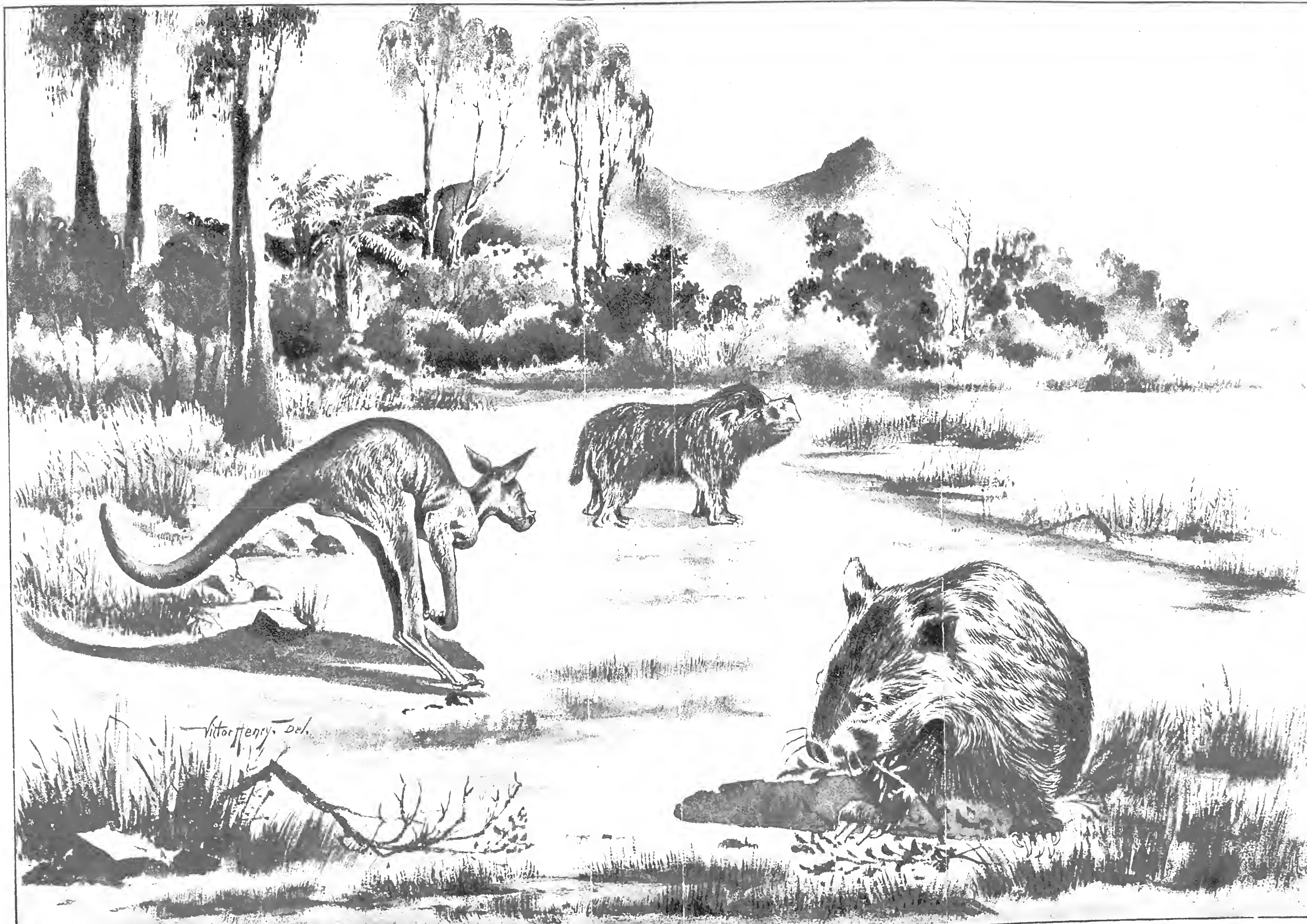
KEY TO THE PLATE.

To Left.—"Palorchestes," the giant of all kangaroos, the skull being some 17 inches long.

Middle Distance.—"Nototherium," a marsupial with rhinoceros and tapiroid characters. Size, 9 feet long, 5 feet high, and nearly 3 feet across the hips.

To Right.—"Phascolomus," a giant wombat, as large as a modern donkey.

Sketch by Mr. Victor Henry, Launceston.



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